Chapter 5 – Uncertainty Analysis

5.1 Introduction

The results presented in this RA depend on a number of factors, including the availability of pertinent scientific information, standard RA practices, exposure assumptions, toxicity assumptions, and Ecology policy decisions.

Uncertainties are introduced into a RA because a range of values could be used for each assumption (i.e., parameter). Typically, more conservative (i.e., upper bound) values are generally chosen for each parameter, while other values (i.e., values closer to the central tendency) may be more representative of site-specific conditions. Choosing upper bound values for each parameter typically results in overly conservative risks that do not reflect site-specific conditions.

5.2 Uncertainties

Sources of uncertainty identified in the human health evaluation and professional judgment regarding the direction and magnitude of the impacts on the risk results are presented in Table 5-1. The direction and magnitude are those assumed to remain after any actions listed in the comment field have been implemented. This is done to qualitatively evaluate how much the risks and associated CLs might change if different values were used or if an alternative assumption or decision was made. In other words this uncertainty analysis provides a qualitative estimate of the confidence that the cleanup and remediation levels presented herein will be protective of the land-use and receptors on which they are based. The key study-specific uncertainties associated with the risk calculations and associated CLs and RLs are discussed in detail below.

5.2.1 Future Land Use

There is uncertainty associated with future land use at the Site. The RA assumed that future land use would include commercial, recreational (i.e., a golf course), historical, and open space for the purposes of developing RLs. If the Site was used for other purposes (e.g., residential) the RLs may not be protective. This uncertainty is very low because there are land use restrictions being imposed on the property to ensure that future land use is consistent with the assumptions made in the RA. Deed restrictions to limit Site uses will be imposed for different land uses including commercial, recreational (golf course), historical, industrial, and open space (Ecology, 2003). The City of DuPont zoning for the Site does not include any areas to be used for residential purposes (City of DuPont, 2001). An additional deed restriction will be required for the property inside the golf course footprint that limits this property to that sole use and places restrictions on activities that could disturb the cap/cover. In addition, the construction of an engineered cap/cover as part of the golf course placement areas also reduces the uncertainty that the property will be used for other purposes which would result in unaccounted for exposures to affected soil. Overall, the confidence that the future land-use will be consistent with what was evaluated in the RA is very high.

5.2.2 Exposure Factors

There is uncertainty associated with the exposure factors used to determine the CLs and RLs including the incidental soil ingestion rates. The default MTCA Method C scenario assumes that an adult industrial worker ingests 50 mg of soil each day. The CLs and RLs identified in this evaluation are based on the assumption that the commercial or golf course worker ingests 200 mg of soil each day. The uncertainty surrounding incidental soil ingestion rates is low due to the fact that a higher ingestion rate was used to develop the CLs and RLs.

5.2.3 Groundwater as a drinking water source

Drinking water was not evaluated in the RA because COPC concentrations in the RI indicated that, other than low DNT concentrations that were detected in 6 wells, groundwater is not a medium of concern. There is though, uncertainty associated with the use of groundwater as a drinking water source. Site groundwater is not currently used as a drinking water source. In the future, a deed restriction will be placed on the Site to restrict the use of groundwater to non-potable uses only, until such time as it meets

CLs. In addition, the capacity of off-Site drinking water supplies (which are located upgradient of the Site) is more than double the capacity needed for the projected population of DuPont through the year 2020 (WSNW, 2003). Therefore, the uncertainty associated with future groundwater use is low.

5.2.4 Arsenic Area Background Concentration

There is uncertainty associated with determining the background arsenic concentration at the Site. This area background concentration was determined after collecting twenty-three soil samples from unbiased locations outside of the Site consent decree boundary to define "Site background" soil quality in accordance with MTCA. The majority of samples were obtained from locations to the south and east of the Site. Ecology approved the use of the 32 mg/kg (i.e., ppm) as the area background concentration for arsenic in 1996. The confidence in this value being representative of area background concentrations is high.

5.2.5 Ecological Evaluation

There is uncertainty associated with ecological evaluation. Ecology performed an evaluation of the Site and determined that lead is the indicator compound for potential terrestrial ecological impacts. As part of this evaluation, Ecology determined that, based on site-specific information, the potential species groups of concern included ground-feeding birds and herbivorous small mammals. The soil screening level identified for lead by Ecology is 118 mg/kg, and is intended to be protective of wildlife, including birds and small mammals. This concentration is based on an exposure scenario which assumes that there are earthworms present in the contaminated soil and that robins are eating the earthworms. Overall, the confidence in this value being protective of ecological receptors is very high.

5.3 Conclusion

The MTCA rule, scientific information, site-specific factors, and the associated uncertainties were considered during the process of developing CLs and RLs. In general, when faced with uncertainty, more stringent assumptions were used in the evaluation so that the final result is CLs and RLs that are more health protective.

Table 5-1
Summary of Uncertainties in the Human Health Evaluation and Site-Specific Characteristics

Source of Uncertainty	Direction[(a)]	Magnitude[(b),(c)]	Comment
Key Uncertainties			
Future Land Use	+/-	0	Deed restrictions, zoning, and physical cap over the placement areas in the golf course together minimize the chance that future land use will be different than what was assumed in the RA.
Incidental Soil Ingestion Rate	+	2	The incidental soil ingestion rate that was used is 4 times higher than the MTCA default value.
Groundwater as a drinking water source.	+/-	0	The groundwater at the Site is not currently used as a drinking water source and deed restrictions will ensure that it is not used as a source in the future.
Area-wide arsenic background concentration	+/-	0	The area-wide concentration was determined according to the methodology prescribed in MTCA and ultimately approved by Ecology for use at the Site.
Ecological Evaluation	+	2	The screening concentration identified by Ecology was used as the cleanup level.
Other Uncertianties			
Quality of Analytical Data	+/-	0	Quality-assured data were used in the evaluation.
Identification and characterization of COCs present in soil.	+/-	0	The Site is well characterized with 21,933 soil sample analyses (5,182 samples), 12,038 groundwater sample analyses (283 samples), and 1,528 surface water sample analyses (344 samples).
Soil samples were not sieved through a < 250 mm screen.	-	1	EPA issued guidance recommending sieving soil samples for lead only. If this was done the lead concentrations in soil would be higher (i.e., the lead concentrations reported by the laboratory would be higher because lead is generally found in the finer soil fraction).
Exposure Frequency and Duration	+	1	MTCA default and Site-specific exposure Factors were used in the evaluation. The exposure frequency assumes that a commercial landscaper is working in the affected soil 2 days/week for 20 years.
Extrapolation from animal studies to human toxicity	+	3	U.S. EPA's conservative approach incorporating safety factors and upper-bound estimates was used in the evaluation.
Historical versus recent RA assumptions impact on CLs and RLs	+/-	0	Site-specific CLs and RLs have been developed over the course of many years and in some cases this results in differences in exposure scenarios and associated assumptions (see Appendix C) between older and newer agreements.

[(a)]Direction of Effect on Risk Calculations + = May result in risks that are overly conservative.
- = May result in risks that are not conservative.

[b]Magnitude of Effect on Risk Calculations
0 = Negligible impact on risk calculations.
1 = Small effect on risks calculations.
2 = Medium effect on risk calculations.
3 = Large effect on risk calculations.

[c]Direction and Magnitude values based on professional judgment.

5.4 References

City of DuPont. 2001. City of DuPont Comprehensive Land Use Plan. Adopted by Ordinance No. 01-698. November 13, 2001.

Ecology. Washington State Department of Ecology. 2003. Cleanup Action Plan for the Former DuPont Works Site, DuPont, WA.

WSNW. West Shore Corporation NW. 2003. Feasibility Study for the Former DuPont Works Site, DuPont, Washington.